



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁵ :

H04N 7/10

A1

(11) International Publication Number:

WO 91/18476

(43) International Publication Date:

28 November 1991 (28.11.91)

(21) International Application Number: PCT/US91/03581

(22) International Filing Date: 21 May 1991 (21.05.91)

(30) Priority data:

526,103

21 May 1990 (21.05.90)

US

(71) Applicant: CONTROL DATA CORPORATION [US/US]; 8100 34th Avenue South, Bloomington, MN 55425 (US).

(72) Inventor: COHEN, Gerald, B. ; 1 Bethany Court, Gaithersburg, MD 20879 (US).

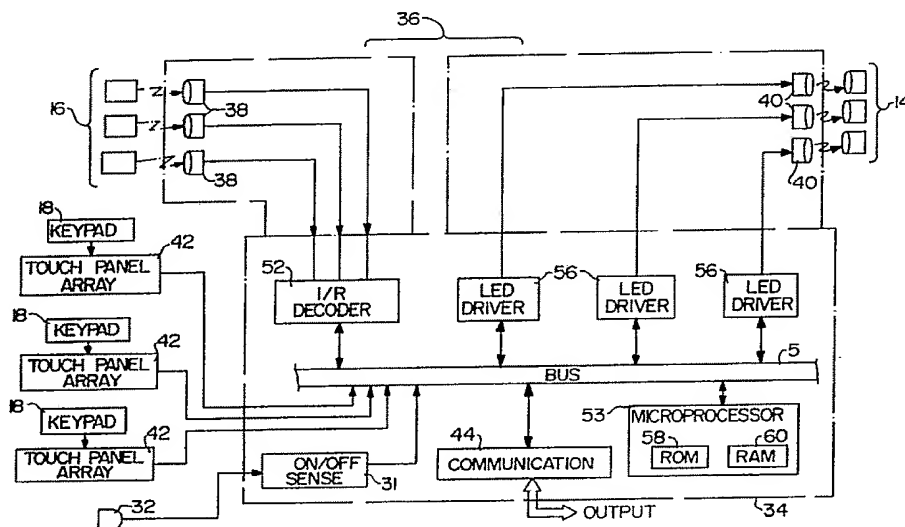
(74) Agent: FLANAGAN, Eugene, L., III; Curtis, Morris & Safford, 530 Fifth Avenue, New York, NY 10036 (US).

(81) Designated States: AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent).

Published

With international search report.

(54) Title: NON-OBTRUSIVE PROGRAMMING MONITOR



(57) Abstract

A meter for unobtrusively monitoring the tuning of a home entertainment center. The device is able to work with remote controls of components of the center. The present invention receives signals from the remote control(s), decides to which component the signal was intended, sends an infrared signal to the proper component, and stores tuning information regarding the center. The stored information may be retrieved at a later time and used to make programming decisions. The present invention includes infrared sensors which receive the signals from the remote(s), a microprocessor, and transmission means to transmit the signal to the intended device. Alternatively, the control signal may be generated by a touch panel array placed over digital keypads of the center's components. When a key is pushed, the control signal is generated. The touch panel array(s) can serve solely or in combination with the remote control(s) to generate control signals.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	ES	Spain	MG	Madagascar
AU	Australia	FI	Finland	ML	Mali
BB	Barbados	FR	France	MN	Mongolia
BE	Belgium	GA	Gabon	MR	Mauritania
BF	Burkina Faso	GB	United Kingdom	MW	Malawi
BG	Bulgaria	GN	Guinea	NL	Netherlands
BJ	Benin	GR	Greece	NO	Norway
BR	Brazil	HU	Hungary	PL	Poland
CA	Canada	IT	Italy	RO	Romania
CF	Central African Republic	JP	Japan	SD	Sudan
CG	Congo	KP	Democratic People's Republic of Korea	SE	Sweden
CH	Switzerland	KR	Republic of Korea	SN	Senegal
CI	Côte d'Ivoire	LI	Liechtenstein	SU	Soviet Union
CM	Cameroon	LK	Sri Lanka	TD	Chad
CS	Czechoslovakia	LU	Luxembourg	TG	Togo
DE	Germany	MC	Monaco	US	United States of America
DK	Denmark				

NON-OBTRUSIVE PROGRAMMING MONITOR**BACKGROUND OF THE INVENTION****Field of The Invention:**

This invention relates to the monitoring of home
5 entertainment centers having components with either digital
controls thereon or digital remote controls. More
particularly, the present invention can monitor the
programming enjoyed by an audience through an audio/video
receiver (such as a television or audio receiver), even
10 though the programming may be coming from any of a number of
sources such as over the air, from a cable or from a video
cassette recorder (VCR).

Description of the Prior Art:

In the entertainment industry, ratings are all
15 important for determining advertising rates and for adjusting
programming. The viewing habits of an audience must be
monitored to generate the ratings without altering or
distributing such habits. Any monitoring equipment must
present the same or equivalent ergonomics that the viewer had
20 previously enjoyed. Information obtained from such
monitoring is used by networks and other programming sources
in making programming decisions, especially since the
entertainment industry is locked in fierce competition for
larger shares of the viewing market.

25 Television monitoring systems have recently been
developed and are described in the patent literature. U.S.
Patent 4,769,697 to Gilley et al. teaches a passive
television audience measuring system. This system accepts
viewer responses concerning the programming being watched,
30 and can therefore collect viewer as well as programming
information. However, this information must be supplied by
the viewer. No suggestion is made concerning how to monitor
complete home entertainment centers that include cable and
VCRs, particularly without viewer input.

35 U.S. Patent 4,613,904 to Lurie also discloses a
television monitoring device. This device monitors a rolling
bar code that is displayed when initiating viewing or
switching channels. This device does not monitor a plurality
of components nor is it unobtrusive as it requires a

-2-

photocell to cover a section of the television screen so that the rolling bar code can be detected. There is no suggestion that this device may be used with a plurality of components.

Another patent to Lurie, 4,626,904, discloses a
5 device for passively logging the presence and identify of viewers of a television, and stores channel information. This device requires that all the viewers wear headphones and is therefore not "ergonomic".

A final patent to Lurie, number 4,779,198, deals
10 with an audience monitoring system. This device is particularly oriented towards monitoring people entering and leaving a room. Each entrance to a room is fitted with a motion detector. In response to the detector the monitor records when people come and go and further records channel
15 selection from the television. There is no mention of monitoring a complete home entertainment center.

Systems for detecting and monitoring the channel to which television receiver systems are tuned are known in the art. However such systems are not useful with
20 entertainment systems having plural components with digital controls or digital remote controls. Previous monitoring systems are disclosed in U.S. Patents 4,605,958 and 4,816,904 to Machnik et al. and McKenna et al. respectively.

Machnik et al. monitors the channel selected by a
25 cable converter of a television system and stores information pertinent thereto. The cable is attached to the device which monitors the signal. The output of the device is applied to the cable converter.

McKenna et al. disclose remote units that are
30 controlled from a central location, each unit being attached to a television receiver. The device can store information relating to television mode as well as viewer identification.

Previous patents have disclosed a "smart" or reconfigurable remote control transmitter which may be used
35 with a plurality of remotely controlled products, each of which is normally controlled by signals from an associated remote control. Such a device is taught by Evans et al. in

-3-

the U.S. Patent 4,825,200. A similar device, which is capable of learning, storing and repeating the control codes from any other infrared transmitter, is disclosed in both U.S. Patent 4,626,848 to Ehlers and U.S. Patent 4,623,887 to Welles, II. Seymour et al. in U.S. Patent 4,709,412 teaches a device which can hold a plurality of infrared remote controls.

While all of the devices above have the ability to learn the functions of other remote controls, none teach or suggest recording the information about channel selection or about which device is in use at certain times for later retrieval and analysis.

Dockery, U.S. Patent 4,809,359, teaches a system for extending the effective operational range of an infrared remote control system using a radio signal. A remote control transmitter incorporated into a television receiver is disclosed by Rumbolt et al. in U.S. Patent 4,841,368. Uehira, in U.S. Patent 4,755,883, discloses a removable information inputting device. Uehira is intended to put information into an electronic device so that a specific function, such as taping a movie on a specific day and time, may be carried out. U.S. Patent 3,641,299 to Mayer discloses a switch having a transparent area that is suitable for placement over a video display.

Hence, the prior art is deficient in not being able to unobtrusively monitor the viewing habits of an audience with regard to a home entertainment center where multiple components can receive signals from multiple sources. None of the known prior art can transfer information from one or more remote controls or on-device digital inputs to the appropriate piece of equipment in a home entertainment center and at the same time store data relating to what piece of equipment was in use at what time and what channel of a television was being viewed.

35

SUMMARY OF THE INVENTION

The present invention provides a device that can receive a digital command, transfer it to the appropriate

-4-

member of an entertainment system, store information reflecting what piece of equipment was in use and what channel was the active channel of the television and later transmit such information to a central computer.

5 The present invention accurately monitors and meters the audio/video (A/V) tuning and channel selection of a digitally controlled home entertainment center in an unobtrusive manner so that control signals are not interfered with and there is no requirement for any electrical
10 connections to the tuning systems of the components of the entertainment system. The present invention is not utilized in lieu of the A/V receivers of the system, rather it cooperates with them. Further, the present invention cooperates with any remote control devices associated with
15 the entertainment system components.

 The present invention collects data concerning usage of a programming monitor component of a home entertainment center by monitoring at least one component of the center that is controlled by control signals. The
20 invention includes sensor means that detect the control signals, means that transfer the signal to the component for which it was intended, data generating means which create data based on the control signals regarding use of the programming monitor component, and outputting means for
25 outputting the data.

 Therefore, the present invention, without using probes or any obtrusive apparatus or methods, presents an effective method for monitoring the tuning of entertainment systems. The invention is especially effective as today's
30 A/V equipment has a greater usage of computerized circuitry, modern keypads, infrared remote controls and multimedia configurations including TV/VCR, picture-in-a-picture and other special effects.

BRIEF DESCRIPTION OF THE DRAWINGS

35 Other objects, features and characteristics of the present invention, as well as the methods of operation and functions of the related elements will become apparent upon

-5-

consideration of the following description and the appended claims with references to the accompanying drawings, all of which form a part of this specification, wherein like reference numerals designate corresponding parts in the 5 various figures.

FIGURE 1 is a perspective view of the present invention arranged on a home entertainment center that includes a television, cable and a VCR;

FIGURE 2 is a block diagram of the apparatus 10 pictured in FIGURE 1, with no television, cable or VCR being depicted; and

FIGURE 3 is a flowchart illustrating the remote control monitoring performed by the apparatus pictured in FIGURE 2.

15

**DETAILED DESCRIPTION OF THE PRESENTLY
PREFERRED EXEMPLARY EMBODIMENT**

FIGURE 1 illustrates a typical home entertainment center including a television 10, a VCR 11 and a cable converter 12. Remote control units 16 are provided for 20 controlling television 10, VCR 11 and converter 12, respectively, by selectively emitting infrared control signals. Television 10, VCR 11 and converter 12 receive the control signals from the remote control units 16 through infrared receptors 14. Digital keypads 18 can also be used 25 to input commands to television 10, VCR 11 and converter 12.

Monitor 34 is plugged into a wall outlet 30. Television 10, VCR 11 and converter 12 are plugged into ON/OFF sense detector 32 which informs monitor 34 when the home entertainment center is in use. When the user turns on 30 television 10, VCR 11 or converter 12, that information is recorded by monitor 34. Receptors 14 in television 10, VCR 11 and converter 12 are covered by sensors 36, including a receiver 38 and a transmitter 40. When television remote control 16 is used to turn on television 10, the infrared 35 (IR) beam emitted by remote control 16 falls on receiver 38 which transfers the signal to monitor 34. Monitor 34 then regenerates or at least passes the signal to transmitter 40

-6-

which emits an IR beam to television 10. Channel selection, using remote control 16, is stored in monitor 34 for future retrieval. Converter 12 has a sensor 36 similar to that associated with television 10. Likewise, VCR 11 has a sensor
5 36.

Instead of providing a separate receiver 38 and transmitter 40, each sensor 36 may be transparent. In this case, the incoming infrared beam carrying the control signal impinges on sensor 36. Information coded into the beam is
10 transferred directly to the component for which it is intended, and at the same time the information is transferred to monitor 34. In a preferred embodiment, each sensor 36 is not transparent. This insures that the incoming infrared beam is always intercepted for proper detection by monitor
15 34 and is subsequently passed to television 10 by transmitter 40. Such is also the case with sensor 36 for the converter 12 and VCR 11.

Television 10 may also be controlled through digital keypad 18. The present invention provides a touch
20 panel array 42 which is mounted over keypad 18. Such an array can recognize which key is being pushed and relate this information to monitor 34 for storage and later retrieval. Keypad 18 on VCR 11 and keypad 18 on converter 12 are also provided with touch panel arrays 42 that relay information
25 to monitor 34.

Each touch panel array 42 is fabricated of commercially available touch sensitive materials. Alternatively, it may be formed as a mechanical assembly designed so as to fit over the digital controls 18 of the
30 component. Each time a key or button is depressed, it can be detected by its location within the array. In a preferred embodiment, a mechanical assembly is designed so as to fit over digital controls 18 of the component such that the viewer is denied access to the digital controls. Touch panel
35 array 42 is constructed of commercially available materials such that it becomes a "substitute" keypad having the equivalent ergonomic features of the original component's

-7-

digital keypad 18. Each time a key on touch panel array 42 is depressed, monitor 34 recognizes the key(s) that are pushed and responds accordingly by reconstructing the equivalent and is subsequently passed to the television 10 by the transmitter 40. The touch panel arrays 42 for VCR 11 and converter 12 work the same way as does touch panel array 42 associated with television 10.

Monitor 34 will now be described with reference to FIGURE 2. Each of the remote control units 16 emits an infrared signal that is received by receiver 38. The IR signal is changed to electrical impulses that IR decoder 52 translates to generate a signal indicating the component of the home entertainment center being operated on and in what manner. For example, when remote control 16 for television 10 is used to change channels, IR decoder 52 transfers this command through bus 51 to microprocessor 53. Microprocessor 53 decodes the IR input and directs a corresponding signal toward transmitter section 40 which is juxtaposed with television IR receptor 14.

Transmitter section 40 is made up of I/R light emitting diodes (LED) that emit I/R signals for receptors 14. Each LED transmitter 40 is driven by a corresponding IR LED driver 56 which receive a command signal from microprocessor 53.

The input signals that are decoded by I/R decoder 52 with the assistance of microprocessor 53 are used to drive the LED drivers 56. In order to effectively route the incoming I/R signal to the intended LED transmitter 40, the microprocessor must go through a "learning routine". As this routine is similar to the learning routine that the "smart" or reconfigurable remote controls discussed above must undergo, the learning process will not be described in detail.

Microprocessor 34 "learns" the various types of signals at the time the invention is installed. "Learning" includes recognizing and discerning the corresponding functions of remote control units 16 associated with the

-8-

entertainment center and the meaning of each digital control on each of keypads 18 covered by each of the touch panel arrays 42. The purpose of the learning phase is to enable microprocessor 53 to associate all remote control functions with their meaning. In this manner, microprocessor 53 can discriminate those functions that are tuning relevant from functions which are not tuning relevant such as volume control.

Microprocessor 53 includes a read only memory (ROM) 58 in which the system programming is stored. Microprocessor 53 also includes a random access memory (RAM) that stores both information regarding the tuning of the entertainment system for later retrieval and the functions of the different remote control signals.

On/Off sense 31 receives and communicates a signal to the microprocessor 53 via bus 51 whenever a component of the system is turned on or off. On/Off sense 31 passes the information to microprocessor 53 where it is stored in RAM 60.

System function will now be explained with reference to FIGURE 3. At first, the meter remains idle in step 70. The present invention awaits for a control signal from any of the remote controls 16 of the source device(s) such as the television 10, VCR 11, cable converter 12, etc. or commands from keypads 18, sensed by touch panel arrays 42.

The system proceeds to step 76 in which the device to which the IR signal is being directed to is selected, or the signal can be broadcast to all devices. This is possible because all the pieces that could receive the IR signal are constructed so as to only respond to their own signals. That is, the television only responds to signals from the television remote, the cable to signals from a cable remote, the VCR to signals from a VCR remote, etc. Each device will not respond to signals directed at other remotes, so that it is acceptable to always drive every LED driver 56 and IR LED 54. The only device which will respond to the LED(s) 54 is the device for which the signal was intended. Signals for

-9-

different devices are coded differently. The infrared signals are a combination of short and long pulses and spaces. The idea is comparable to signalling in morse code with a flashlight.

5 In step 78, monitor 34 then transmits the IR signal to selected devices by energizing LED driver(s) 56 which in turn cause LED(s) 54 to emit an IR light beam at selected components. It is possible that one driver powers all the LEDs rather than using one driver for each LED as depicted
10 in FIGURE 2.

The system proceeds to step 74 in which microprocessor 53 checks if the control signal received from a remote control 16 in step 72 is a valid one and if the event should be logged in step 80. Step 74 determines if the
15 received IR signal is intended for a device that is not being monitored by the present invention. For example, such signals could be generated by children's toys. Alternatively, as volume typically need not be monitored, volume commands need not be logged in step 80, whereas an
20 audio mute signal would be logged in step 80. If the code received in step 72 is invalid or is not to be logged in step 80, the system returns to idle at step 70.

If the control signal is received from touch panel array 42 in step 73, the system in step 76 performs as though
25 the control signal originated in step 72.

Data pertinent to viewing preference is date and time stamped and the information is stored in RAM 60 at step 80, to be later retrieved and reported to a host system. Such information will be utilized to determine programming
30 preferences at a later time. Information such as volume level is not pertinent and therefore is not stored in RAM 60. At certain times, the data is to be transmitted to the host system. This could be at a specified time and date via a modem, Local Area Network (LAN) or when the apparatus is
35 disconnected from the entertainment system. If it is determined that the data is to be transmitted at that time in step 82, the system continues with step 84 in which

-10-

transmission occurs. Communication device 44 serves as the interface between the meter and the outside world in that device 44 serves as the link to the host collection system. If step 82 determines that data is not to be reported to the host collection system, the invention returns to its initial idle state at step 70, awaiting another IR signal. After data transmission in step 84, the invention also returns to the idle state.

If from the idle state at step 70, a signal to be monitored is received from a touch panel array in step 73, the signal is logged at step 80. In the preferred embodiment, if a signal to be monitored is received from a touch panel array 42 in step 73, the system proceeds to step 85 in which monitor 34 ascribes the appropriate IR signal to that received from touch panel array 42. The system then proceeds to step 76 in which the device for which the signal was intended is selected and then to step 78 where the IR signal is transmitted to the component.

If the data is to be transmitted in step 84, such is transmitted to a central host computer (not shown) that analyzes the data and determines what viewers are watching/listening to.

For example, if the home entertainment center contained a television, a VCR and cable and a movie was being watched on the VCR, the present invention would transmit that the television was on and that the VCR was on, while the host computer would interpret this information to mean that the VCR was supplying the active signal. The state of all components making up the home entertainment system must be considered by the host computer to enable it to determine which component is supplying the signal. If the television receiver is tuned to an empty channel while a cable converter is tuned to channel 23, then cable channel 23 is the selected A/V source. Alternately, if the television is tuned to a non-empty channel, for example channel 5, then channel 5 is the true A/V source. The information transmitted by the present invention to a host computer allows the host computer

-11-

to determine what device was supplying the signal and to create relevant programming data.

A device and method have been proposed that are able to meter most, if not all, entertainment systems with 5 digital controls and/or digital IR remote control. The method and apparatus are unobtrusive and ergonomic and able to accommodate picture-in-a-picture television, HDTV, and multimedia entertainment centers. Further, the present invention has the advantage of reducing cost by eliminating 10 duplicative equipment. This is achieved by the present invention's ability to monitor the tuning of several devices concurrently where normally each piece of equipment would require its own individual meter.

While the present invention has been described in 15 connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention is not limited to the disclosed embodiment. On the contrary, the invention is intended to cover various modifications and equivalent arrangements 20 included within the spirit and scope of the appended claims.

-12-

WHAT IS CLAIMED IS:

1. An apparatus for collecting data concerning usage of a programming monitor component of a home entertainment center by monitoring at least one component of said home entertainment center controlled by control signals, comprising:

sensor means for detecting said control signals;

means for transferring said control signals to said at least one component;

means for generating data concerning usage of said programming monitor component, determined from said control signals; and

means for outputting said data from said generating means to allow usage of said programming monitor component to be monitored.

2. Apparatus as in claim 1, wherein said sensor means includes infrared receiving means for receiving said control signals from at least one remote control, said at least one remote control unit corresponding to at least one component of the home entertainment center.

3. Apparatus as in claim 2, wherein said transferring means comprising:

means for determining which programming monitor component of the home entertainment center is to receive said control signal;

a microprocessor, which transfers the signals to the component determined by the determining means; and

at least one infrared LED driven by a power source selected by the microprocessor, said at least one LED being juxtaposed to infrared receptors of the at least one component.

4. Apparatus as in claim 1, wherein said sensor means includes a touch panel array positioned over a digital keypad of the at least one component.

-13-

5. Apparatus as in claim 1, wherein said sensor means and said transferring means include a transparent infrared receiver.

6. Apparatus as in claim 1, wherein said outputting means includes a modem.

7. Apparatus as in claim 1, wherein said outputting means includes a Local Area Network.

8. Apparatus as in claim 1, further comprising a microprocessor capable of discerning all signals from the sensor means, said microprocessor further providing memory space for storing said data concerning usage of the programming monitor component microprocessor acting as said transmitting means.

9. Apparatus as in claim 8, wherein said microprocessor includes a random access memory for storing said data concerning usage of the home entertainment center and a read only memory for storing system functions.

10. Apparatus as in claim 1, further comprising an on/off sensor for determining when any components of the home entertainment center are on or off.

11. Apparatus as in claim 10, wherein said home entertainment center includes a television, a VCR and cable, said on/off means determining one of when the television is on and when the television and at least one of the VCR and cable are on.

12. Apparatus as in claim 1, wherein said data includes information regarding which devices of said home entertainment center are in use.

13. Apparatus for collecting data concerning usage of a programming monitor component of a home entertainment center by monitoring at least one component of said home entertainment center controlled by control signals, comprising:

at least one touch panel array positioned over a digital keypad of the at least one component for generating the control signals;

-14-

means for transferring the control signals from the at least one touch panel array to the at least one component;

means for connecting the at least one touch panel array to a means for generating data concerning the usage of said programming monitor component, said connecting means serving to relay the control signals; and

means for outputting said data from said home entertainment center to allow usage of said programming monitor component to be monitored.

14. An apparatus for collecting data concerning usage of a programming monitor component of a home entertainment center by monitoring at least one component of said home entertainment center controlled by control signals, comprising:

at least one infrared remote control unit for generating said control signal;

sensor means for detecting said control signals from said at least one remote control unit;

means for transferring said control signals to said at least one component;

means for generating data concerning usage of said programming monitor component, determined from said control signals; and

means for outputting said data from said home entertainment center to allow usage of said programming monitor component to be monitored.

15. A method of monitoring a home entertainment center with at least one component for data concerning usage of a programming monitor component of the home entertainment center, comprising the steps of:

detecting a control signal from a sensor means of the home entertainment center;

determining which component of said home entertainment center was intended to receive said control signal;

-15-

applying said control signal to the at least the component for which it was intended;

generating data concerning usage of the programming monitor component determined from the control signal;

recording said data concerning usage of the programming monitor component; and

outputting said data.

16. A method as in claim 15, wherein said detecting step includes detecting said control signals from at least one infrared remote control corresponding to said determined programming monitor component.

17. A method as in claim 15, wherein said detecting step includes detecting said control signal from touch panel arrays located on top of digital keypads of said at least one component.

18. A method as in claim 15, wherein said determining step further includes ascertaining what function is to be performed on the determined component.

19. A method as in claim 15, wherein said applying step includes energizing at least one light emitting diode juxtaposed to a receptor of at least the determined component.

20. A method as in claim 15, wherein said recording step includes recording said data in a random access memory of a microprocessor.

21. A method as in claim 15, wherein said outputting step includes using a modem to output said data.

22. A method as in claim 15, wherein said outputting step includes using a Local Area Network to output said data.

1 / 3

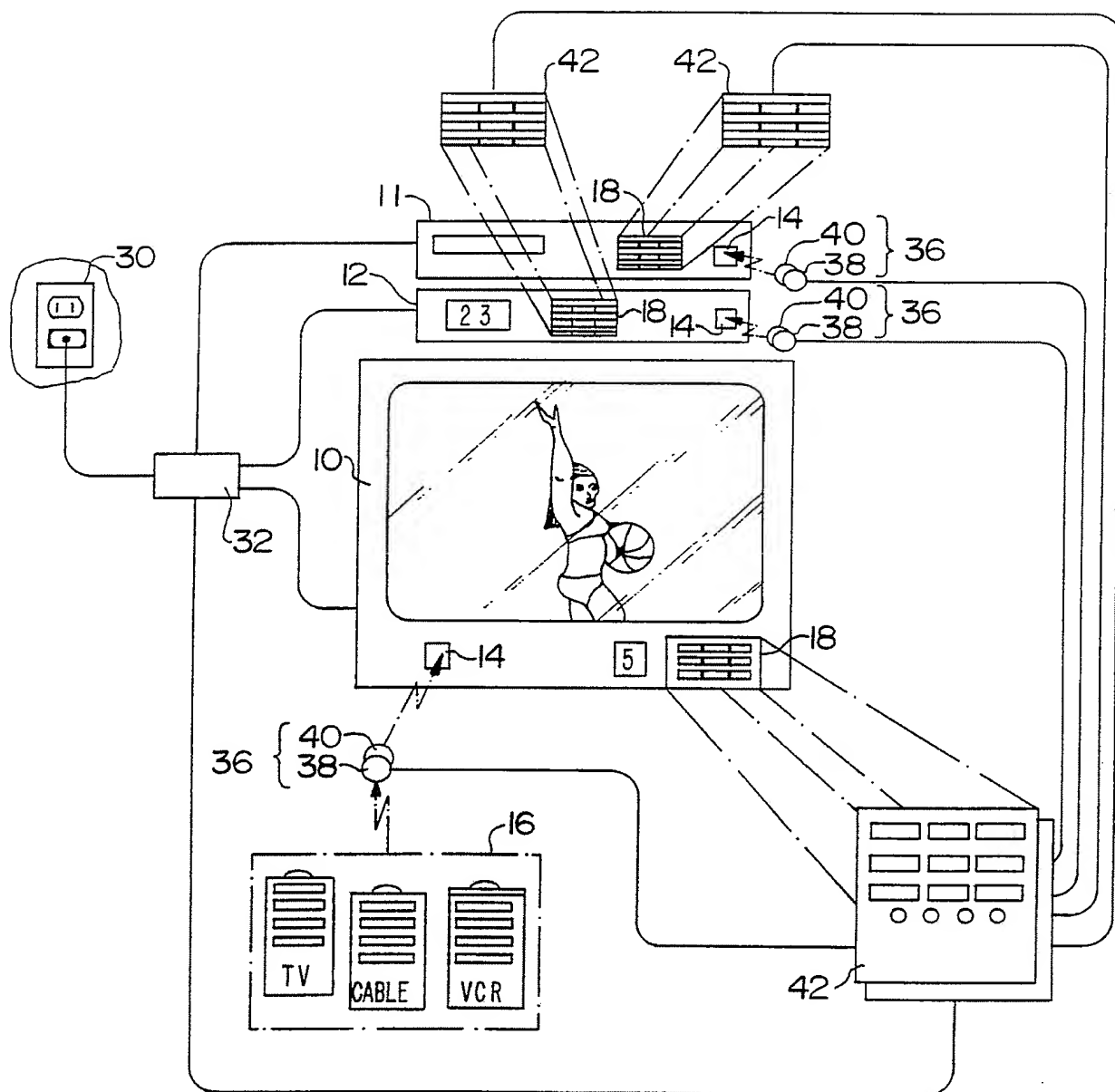


FIG. 1

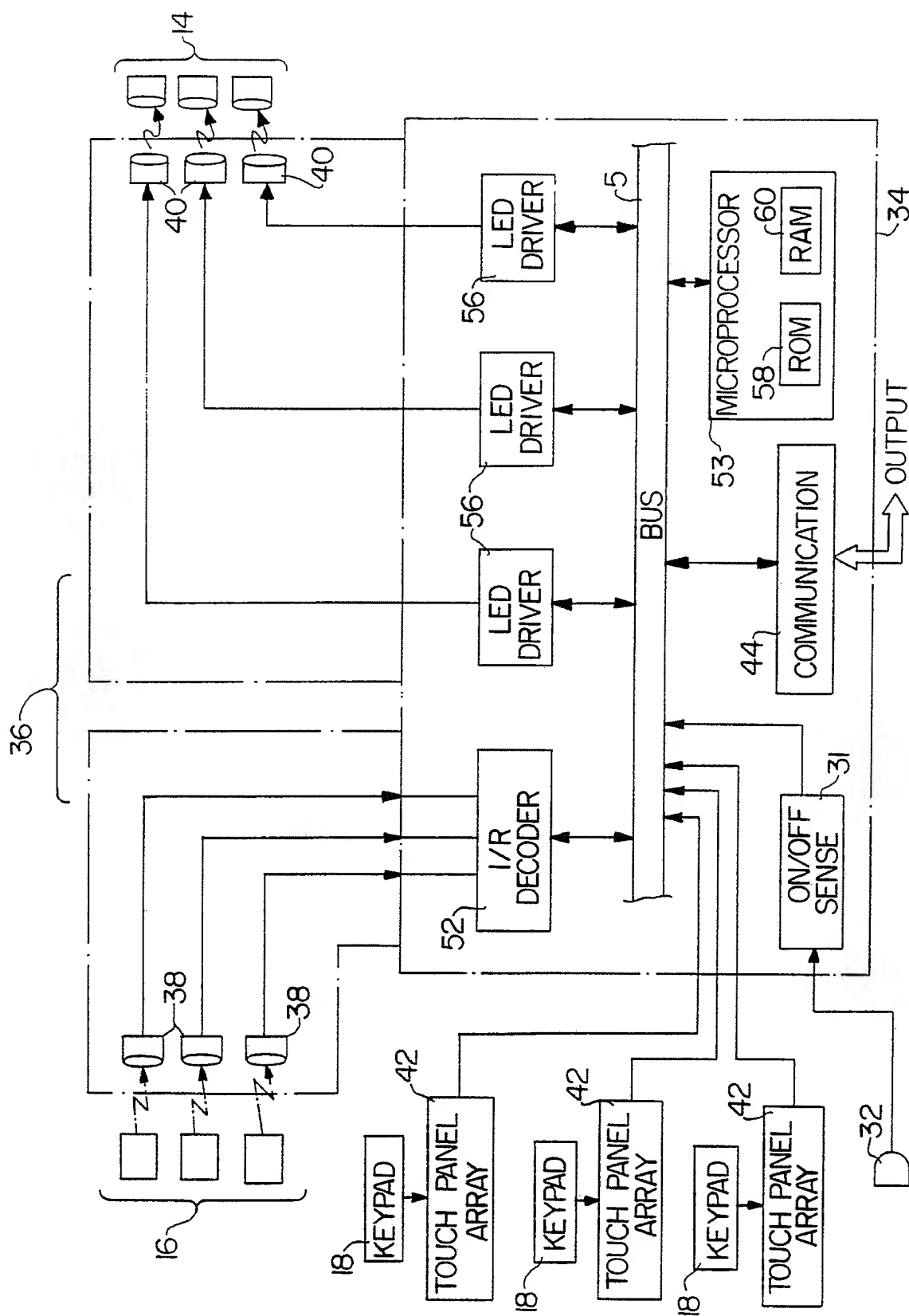


FIG. 2

3 / 3

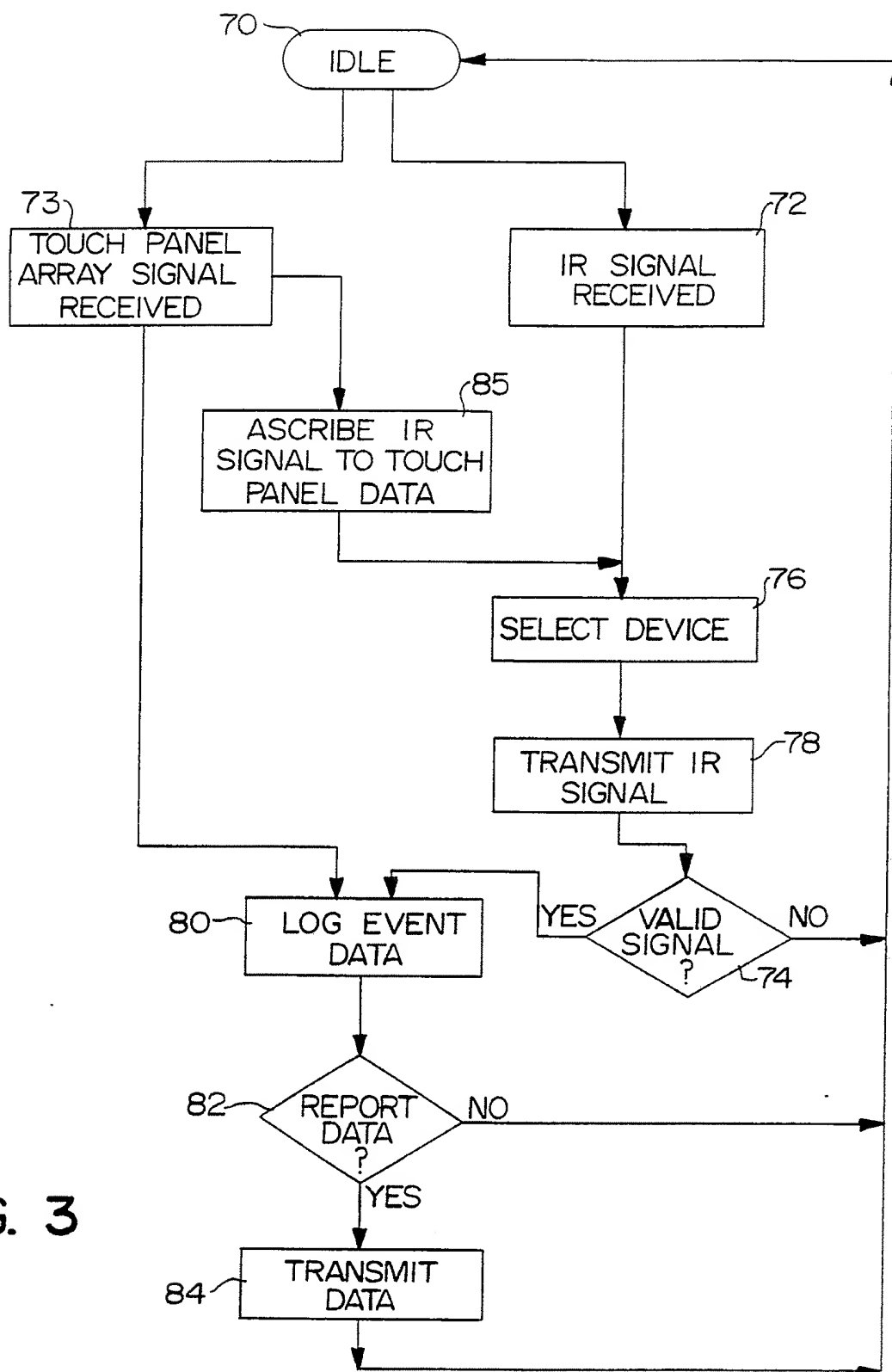


FIG. 3

INTERNATIONAL SEARCH REPORT

International Application No. **PCT/US91/03581**

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC IPC(5): H04N 7/10 U.S. CL: 358/84																	
II. FIELDS SEARCHED <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Minimum Documentation Searched ⁷</div> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 20%; border-bottom: 1px solid black;">Classification System</th> <th style="border-bottom: 1px solid black;">Classification Symbols</th> </tr> <tr> <td style="padding: 5px; vertical-align: top;">U.S.</td> <td style="padding: 5px; vertical-align: top;">358/84, 86 455/2, 3</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸</div>			Classification System	Classification Symbols	U.S.	358/84, 86 455/2, 3											
Classification System	Classification Symbols																
U.S.	358/84, 86 455/2, 3																
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹ <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%; border-bottom: 1px solid black;">Category [*]</th> <th style="border-bottom: 1px solid black;">Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²</th> <th style="border-bottom: 1px solid black;">Relevant to Claim No. ¹³</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; vertical-align: top;">Y</td> <td style="padding: 5px;">US, A, 4,816,904 (MCKENNA et al) 28 MARCH 1989 SEE ABSTRACT</td> <td style="text-align: center; vertical-align: top;">1-20</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">Y</td> <td style="padding: 5px;">US, A, 4,646,145 (PERCY et al) 24 FEBRUARY 1987 SEE ENTIRE DOCUMENT</td> <td style="text-align: center; vertical-align: top;">1-20</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">Y</td> <td style="padding: 5px;">US, A, 4,622,583 (WATANABE et al) 11 NOVEMBER 1986 SEE ENTIRE DOCUMENT</td> <td style="text-align: center; vertical-align: top;">1-20</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">Y,P</td> <td style="padding: 5px;">US,A , 4,943,963 (WAECHTER et al) 24 JULY 1990 SEE ABSTRACT</td> <td style="text-align: center; vertical-align: top;">7,22</td> </tr> </tbody> </table>			Category [*]	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	Y	US, A, 4,816,904 (MCKENNA et al) 28 MARCH 1989 SEE ABSTRACT	1-20	Y	US, A, 4,646,145 (PERCY et al) 24 FEBRUARY 1987 SEE ENTIRE DOCUMENT	1-20	Y	US, A, 4,622,583 (WATANABE et al) 11 NOVEMBER 1986 SEE ENTIRE DOCUMENT	1-20	Y,P	US,A , 4,943,963 (WAECHTER et al) 24 JULY 1990 SEE ABSTRACT	7,22
Category [*]	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³															
Y	US, A, 4,816,904 (MCKENNA et al) 28 MARCH 1989 SEE ABSTRACT	1-20															
Y	US, A, 4,646,145 (PERCY et al) 24 FEBRUARY 1987 SEE ENTIRE DOCUMENT	1-20															
Y	US, A, 4,622,583 (WATANABE et al) 11 NOVEMBER 1986 SEE ENTIRE DOCUMENT	1-20															
Y,P	US,A , 4,943,963 (WAECHTER et al) 24 JULY 1990 SEE ABSTRACT	7,22															
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>[*] Special categories of cited documents: ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div>																	
IV. CERTIFICATION <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-right: 1px solid black; padding: 5px;"> Date of the Actual Completion of the International Search 26 JULY 1991 </td> <td style="width: 50%; padding: 5px;"> Date of Mailing of this International Search Report 19 AUG 1991 </td> </tr> <tr> <td style="border-right: 1px solid black; padding: 5px;"> International Searching Authority ISA/US </td> <td style="padding: 5px;"> Signature of Authorized Officer, EDWARD URBAN </td> </tr> </table>			Date of the Actual Completion of the International Search 26 JULY 1991	Date of Mailing of this International Search Report 19 AUG 1991	International Searching Authority ISA/US	Signature of Authorized Officer, EDWARD URBAN											
Date of the Actual Completion of the International Search 26 JULY 1991	Date of Mailing of this International Search Report 19 AUG 1991																
International Searching Authority ISA/US	Signature of Authorized Officer, EDWARD URBAN																